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Soil Conservation

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Growth Through Agricultural Progress

"We have grown accustomed to dealing with great rivers, with their large problems of navigation, of power, and of flood control, and we have been tempted to forget the little rivers from which they come."
—FRANKLIN D. ROOSEVELT

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Soil Conservation

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Watersheds—Natural Units for Conservation Programs

By Donald A. Williams

JUST as we recognize that an individual farm or ranch is the most practical economic unit to deal with in installing a coordinated soil and water conservation program, we must recognize that a watershed is the natural unit for such a program in most areas. Nearly all our water problems are watershed problems; that is, the best long-range solution usually depends on the proper use, treatment, and management of an entire watershed. Most of our soil conservation problems, except those directly related to wind erosion, can best be solved by proper management of an entire watershed.

A watershed is a natural unit for conservation operations regardless of its size—whether it covers only a few acres culminating in a gully or grassed waterway, or encompasses a large river basin that stretches across several States. But current emphasis centers on the "creek-sized" watersheds, covering from a few thousand to a few hundred thousand acres. Such watersheds are large enough that substantial downstream benefits may accrue from upstream treatment, yet small enough that adequate treatment by community action may be completed in a few years.

The Soil Conservation Service has always recognized that watersheds were natural units for soil and water conservation operations. Most of the early domonstration projects of the Service were small watersheds. Likewise, many of the early soil conservation districts were organized on watershed boundaries. But the present widespread interest in "creek-sized" watersheds has sprung up mainly during the past few years, particularly since Congress passed the "Small Watershed Protection and Flood Prevention Act" (Public Law 566) in 1954.

The current enthusiasm for small watershed projects, under provisions of Public Law 566, may be attributed largely to two things: (1) They are local projects sponsored by local organizations, though they receive Federal and State assistance. Thus, such projects are started only in communities where there is genuine local interest and demand. (2) Most of them are multiple-purpose projects, whereby most segments of the community are affected and benefited. They provide not only for erosion control, flood prevention, and sediment control. They also may provide water for livestock, irrigation, wildlife, and recreational uses; and, in some cases, water for municipal, industrial, or other uses.

The broad authority of Public Law 566, as amended, permits Federal assistance on small watershed projects for almost any type of productive or conservation use of water and related resources. Each project may be tailored to fit the needs and desires of the people living in the watershed. It offers an opportunity for the people of a community—town and country people alike—to coordinate their efforts toward achieving the greatest good for the greatest number in the use and control of the natural resources of their watershed. The main requirements are that local people and sponsoring organizations develop a program and assume their share of the responsibilities and costs, and that the project be economically feasible—that is, the benefits must exceed the costs.

We must not assume, however, that the treatment of whole watersheds is the only soil and water conservation job. A great majority of the Nation's farms and ranches do not lie within watersheds that have been organized for action under the small watershed program. Even though applications for Federal aid under this program had been made for more than 1,400 watersheds covering nearly 100 million acres by the end of 1960, this still represented less than 15 percent of the small watersheds and less than 10 percent of the acreage in them that needed comprehensive treatment of some type. Furthermore, the conservation treatment of the land—acre by acre and farm by farm—is the first, and usually the most important, step in the treatment of any watershed. Floodwater retarding structures and debris basins will likely be short-lived unless the farm, range, and forest lands above them are given proper treatment.

Hence, our foremost goal still must be to help all farmers and ranchers establish conservation programs whereby they will use all land within its capabilities and treat it according to its needs for protection and improvement. Nevertheless, modern needs and demands require the watershed approach to the solution of many community-type problems wherever local organizations are willing to take the initiative and responsibility in such work.

Kiowa Serves As Pilot

For Watersheds in Colorado

By Herbert I. Jones

IF the pilot watershed projects authorized eight years ago were intended to foster similar activities on the part of local groups, then the Kiowa project in Colorado is a resounding success.

Since work began in 1955, thousands of farmers, ranchers, and community boosters from all parts of the State have looked over the Kiowa watershed work and liked what they saw.

Visitors from 19 neighboring watersheds watched closest as the pilot plan developed, and resolved to follow Kiowa's lead.

The result is a growing nucleus of upcoming projects encompassing 1,750,000 acres in central Colorado. Two of the projects—West Cherry Creek and Big Sandy Creek—are under construction. The Coalbank, Vineland, Fishers Peak, and Franktown-Parker projects are approved. Twelve other watersheds in the area are under active study or awaiting preliminary inspection.

Meanwhile, on all the projects under Kiowa's wing, conservation practices are going on the land at a stepped-up pace. Supervisors of sponsoring soil conservation districts and the SCS men assigned to help them are achieving these gains with an increasing number of complete farm and ranch plans.

The upsurge in soil and water conservation work in central Colorado is credited almost entirely to the influence of the Kiowa pilot project. Kiowa is 75,000 acres of practical dollar-for-dollar conservation in an area of sandy soils and steep slopes. Tributary creeks drop 100 to 200 feet per mile and the

The main channel of Kiowa Creek is a sand-choked, mud-baked land hog that meanders across the Colorado landscape at will when heavy thundershowers come: (above) Aerial view of Kiowa Creek as it passes Elbert, Colo.; (below) a closeup view of the Kiowa channel during normal, nonflooding times.

Note:—The author is information specialist, Soil Conservation Service, Denver, Colo.

main creek as much as 50 feet per mile.

The effort to curb rampaging runoff from this watershed has made a mark on the land and in the hearts of the people who know it.

When the last shovelful of earth is turned early this year, Kiowa boosters will be able to point with pride to 62 major floodwater dams. Some will be nearly 60 feet high and a half-mile long, and will contain close to 175,000 cubic yards of earth fill. In addition, there will be 7 sediment control dams and 15,000 feet of channel improvement. Land treatment will include 6,000 acres of grass seeding, 50,000 acres of properly managed range, miles of new terraces, new contouring, waterways, and other conservation work estimated to be two-thirds of a practical goal. All this in spite of four years of drought.

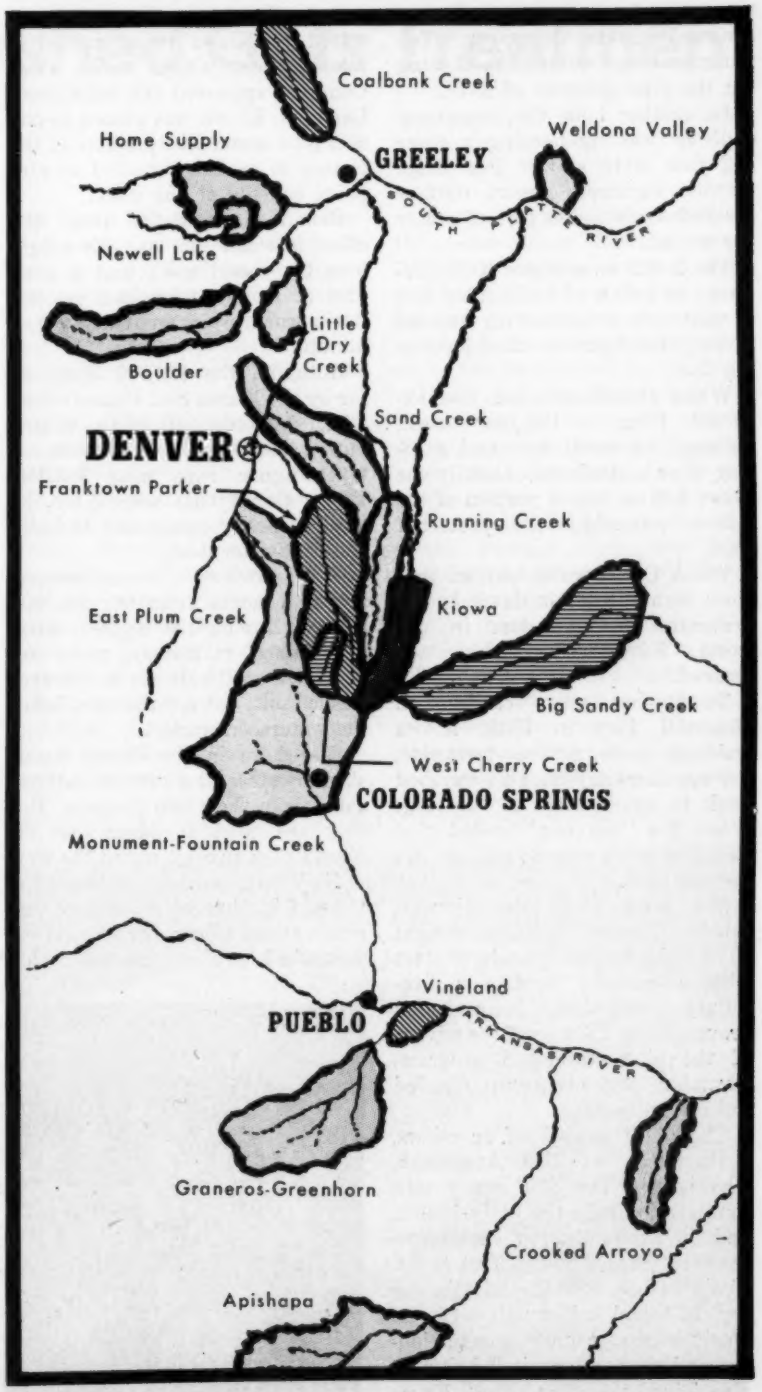
The Kiowa project is designed to cope with the cloudburst storms that periodically sweep the 7,000-foot Black Forest highlands. The structures can easily contain 25-year floods, and 50-year sediment storage is provided. Ungated outlets are set to release all floodwater in 36 hours.

The area's 900 citizens, its towns, roads, and bottomland fields will be spared losses that have run over $42,000 annually during the history of the community. The residents will gain, too, from an added $21,000 annual increase in use of their lands guarded from flooding.

But nature doesn't hold off storms, as all Coloradoans know, waiting for watershed work to be done on Kiowa Creek or elsewhere.

Kiowa watershed construction was barely underway when the project got its first test, on July 30, 1957. That afternoon, one dam, known as K-79, proved its worth in a matter of hours.

The storm began with over four inches of rain pelting down in 45 minutes. Pine-grama-wheatgrass pastures and creek-bottom fields of



Map of central Colorado, depicting small watersheds that are in various stages of organization, planning, or treatment mainly as a result of the successful treatment of the Kiowa Creek pilot watershed project.

the subwatershed were all but drowned in the downpour. Ten minutes later water was flowing out the pipe spillway of K-79.

In another hour the emergency spillway was discharging a river 142 feet wide and 2 feet deep. Service engineers report outflow reached 1,480 cubic feet of water per second.

The 2,262 acres above K-79 produced an inflow of 5,880 cubic feet of water per second which was cut to the 1,400 figure by the functioning dam.

While runoff exceeded that expected from a 100-year storm pattern, the earth dam and spillway were undamaged. Luckily the storm fell on only a portion of the Kiowa watershed—the protected part.

When Coloradoans learned that more than $12,000 in damages was prevented by one dam in one storm, Kiowa's leadership was assured.

Twenty-two years earlier, on Memorial Day in 1935, Kiowa residents were not so fortunate, nor was there any Kiowa watershed work to guard them at the time. When the "big one" ended that day, losses ran over $2 million. Six persons died.

Not long after the disaster, rancher Dewey Carnahan sought out neighbors and friends to start what eventually became a five-county watershed improvement group. From then until the advent of the pilot watershed program, Carnahan and his group pleaded for recognition.

Their zeal rubbed off on others, particularly on Bob Appleman, who became the SCS work unit conservationist in the early 1940's, and on Kiowa district supervisor-ranchers Sam Kimzey, Tom Scott, Jim Foushee, Bill Eisendrath, Joe Jarvis, and Kenneth Sharp. Businessmen, county commissioners, and community-minded citizens also joined the effort. E. G. Kruse was elected chairman of the district watershed advisory committee.

Groundwork by these men resulted in Kiowa being named a pilot project within weeks after Congress approved the legislation. Later on, Kiowa was picked as one of 8 pilot watershed projects in the Nation to be fully studied to pinpoint benefits of the work.

Reminded recently that the effort has cost him and his neighbors 25 years' work and a good deal of money, Carnahan replied, "It's worth every cent and every minute."

Actually, the $12,000 spent so far by the Kiowa Soil Conservation District is only part of the contribution made by the sponsors. A truer figure runs near $85,000. Elbert County has helped, too, by sending heavy equipment to build one floodwater dam.

The county commissioners reaped benefits from the job last spring. During the biggest snowmelt runoff in history, many unprotected road culverts in the area washed out, but not the ones below the watershed work.

Elsewhere in the State, watershed boosters are just as enthusiastic about their own projects. But they are quick to admit that the Kiowa pilot project paved the way.

Hi White, manager of the Wray Colo., Chamber of Commerce and contracting officer for the Wray watershed project, contends that without Kiowa's lead he would not have really understood small watershed possibilities.

A typical gully in the Kiowa Creek watershed.

Under the leadership of White and the Hale Soil Conservation District the Wray watershed project has developed into a $214,000 effort to reduce flood damages to the city and the adjoining agricultural area. Possible damages now are less than 15 percent of what they once were. Control of the 2,500-acre watershed is almost a reality.

Fishers Peak sponsors hope their $270,000 watershed project, approved last June, can duplicate the Kiowa and Wray benefits for the City of Trinidad. A benefit-cost ratio of 1.8 to 1 suggests they can.

The Big Sandy watershed project adjoining Kiowa on the south is being built almost solely for agricultural benefits. Land treatment and 15 floodwater dams will return $1.50 in benefits for every dollar spent. The total Big Sandy watershed protection program will cost nearly $1,249,000.

Before Congress adjourns this year, other central Colorado projects may move from the application-inspection stages to become full-scale developments. At the present time, Home Supply, Crooked Arroyo, and Running Creek seem the best possibilities.

All these projects are being nurtured by farmers, ranchers, and townspeople who are impressed by the things they see at Kiowa. As planning goes ahead, more and more sponsors are filing applications with the State soil conservation board. In the process more and more groups and individuals are casting their lot with watershed sponsors. Already railroads, irrigation companies, pipeline companies, wildlife interests, municipalities, stockmen's groups, farmers' organizations, and many others are joining with local landowners, soil conservation districts, county and State governments, and all the assisting Federal agencies to get watershed conservation done.

Sick Watershed Gets Treatment

By D. E. Sloan

SICK land, like sick people, needs a careful diagnosis, then the right prescription, and finally an applied treatment. This is what the folks in the Elk Creek watershed in Washington County, Ind., have discovered by practical experience. Now, with most of the treatment applied, the symptoms of sick land are disappearing fast: the malignant erosion and flooding conditions are being cured.

The landowners in the Elk Creek watershed diagnosed the "sickness" as deposition of infertile silt and debris in the channel of the creek and on the flooded bottomland. The silt came mainly from 18,020 acres in the upper part of the watershed. The landowners on the upland could not afford to lose their topsoil, seed, lime, fertilizer, and other tangible property. The landowners on the floodplain could not afford to have the infertile silt and debris covering their fertile bottomland and filling the Elk Creek channel and tributaries.

What did they do about it? Let's ask Joe Scifres, president of the Elk Creek Conservancy District. "We started holding neighborhood meetings to try to determine whether there was enough interest to justify asking for assistance," Scifres says. "As soon as Public Law 566 was passed by Congress, the landowners petitioned for assistance. We soon found that getting the facts together and presenting them to the people would be our biggest job. Since our project was the first one in Indiana, we had nothing to show our people."

Melvin Garriott, local contracting officer for the Conservancy District, who farms 360 acres in the watershed, says, "Our job would not have been so difficult had we done a better job of informing the people in the beginning. The educational part of these programs is by far the most important part of the job."

What about the prescription for the problem? Merle McCoskey, who farms 350 acres with his brother, said, "We soon found that water does not pay any attention to line fences. Everyone could see that the way to prevent floods was to catch the water where it hits the earth. We know that it is less expensive to prevent floods than it is to control them after they come. It is less expensive to do this watershed type of flood prevention than it is to build levees and large dams only to have them fill with silt."

Hager Garriott, Jr., secretary of the Conservancy District, says: "The prescription for our flood problem is, without doubt, good land-use treatment on the upland, coupled with detention structures above the bottomland."

How was the prescription applied to the problem? Four of the detention structures were installed after the land above them was given proper land-use treatment. The remaining three structures, stream channel work, and land treatment on the upland will be installed as scheduled.

How have the measures performed? Hager Garriott, Jr., says: "The principal spillways were more than adequate to carry a 5-inch deluge this summer. The multiple-purpose structure on my farm will provide adequate irrigation

Sick land in the Elk Creek watershed that will get conservation treatment under the watershed protection program.

Note:—The author is work unit conservationist, Soil Conservation Service, English, Ind.

water for my cabbage, beans, and sweet corn."

Paul Garriott, Jr., who farms in the extreme lower end of the watershed, says, "Generally, a 2-inch rain over the entire watershed will flood my land. We have had three 2-inch rains since the four detention structures were installed, without flooding. The 5-inch rain in June flooded me, but I feel sure that it would not have caused any damage if all the other structures and the land treatment had been completed."

Merle McCoskey sums it up: "This watershed program has opened our eyes. We are proud to have been the first in Indiana. Everything that has been installed has worked perfectly. We now know that crop damage from flooding will be a thing of the past."

According to Scifres, the outstanding thing has been the splendid cooperation of the landowners and county, State, and Federal organizations to keep the watershed project on schedule. "This cooperation has got to come first, or these projects will not move ahead," he said.

A multiple-purpose floodwater retarding structure on Elk Creek watershed that furnishes water for irrigation, domestic use, and recreation: (above) The dam site before construction; (below) the permanent pool behind the floodwater retarding structure.

What has this program cost? The total cost will be approximately $500,000. The Federal Government will cost-share about 50 percent, and the local landowners and the State will share the remainder. Most of the local share, to date, has been met by voluntary contributions of land and services from the people.

The Indiana Division of Fish and Game assisted the Conservancy District in purchasing the land and cost-sharing on a multiple-purpose structure, built for flood prevention with a permanent water pool for public recereation, primarily hunting and fishing.

The Elk Creek Conservancy District and the Washington County Soil Conservation District are the local sponsoring organizations.

The Washington County Soil Conservation District, as a sponsoring organization, assumes responsibility for the major technical assistance of Soil Conservation Service technicians, and also works with other county, State, and Federal agencies in helping to get soil and water conservation practices applied to the land.

The Elk Creek Conservancy District is responsible for the administration of operations, management, and maintenance of the watershed works of improvement in the watershed program.

◆

Contour farming stored about 2.5 percent more of the annual precipitation than is stored in farming with the slope in recent Kansas experiments. However, contour farming with terraces increased moisture storage by about 5 percent.

Flood Problems
On Florida Flatlands

By Sellers Archer

IN an 8-day period last fall, Hurricane Florence dumped up up to 15.5 inches of rain on two adjoining watersheds on the east coast of Florida. They were the Sebastian River Drainage District which had been approved for operations under Public Law 566, and the Fellsmere watershed which was in the process of organizing. Both had partially effective drainage systems.

Floodwaters covered nearly 70,000 acres of the 81,400 acres in the two watersheds. Much of it remained for 20 days. Damage was estimated at $208,900. Watershed planners believe that if both areas had been treated with projects such as the one planned for the Sebastian Drainage District, damages would have been reduced by $141,900.

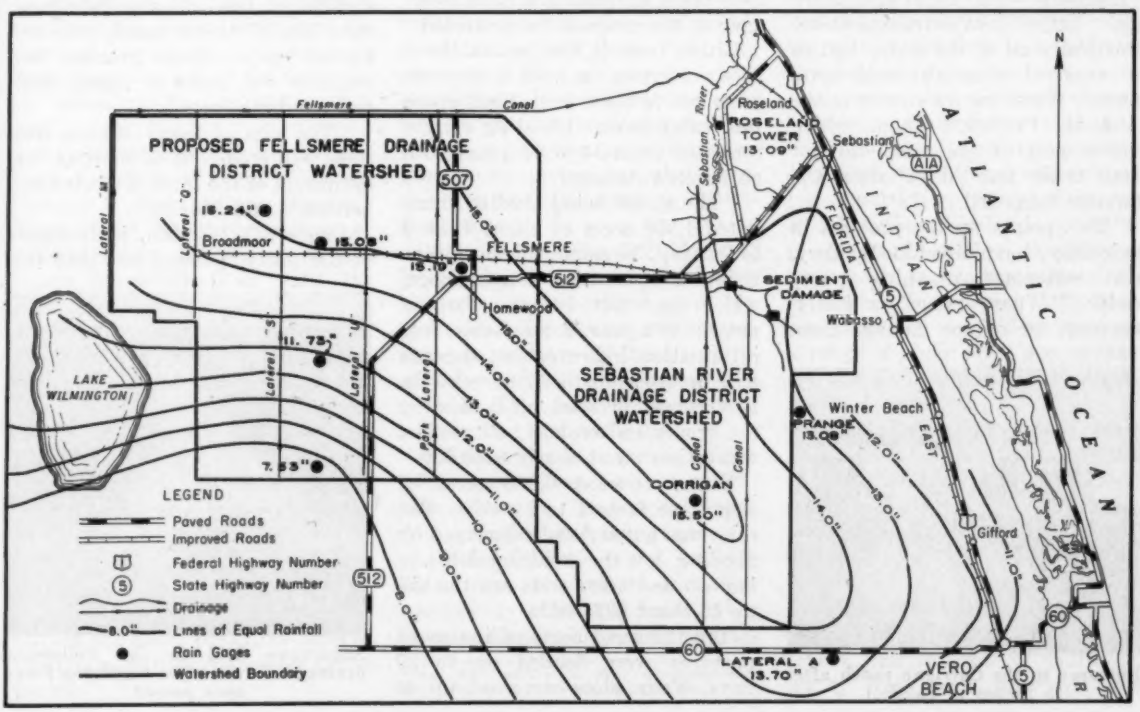
The storm gave SCS technicians an opportunity to measure the hydrologic and economic planning procedures used in the flatland watersheds of Florida. Water stood in citrus groves, sugarcane fields, and pastures for varying lengths of time—up to three weeks. Watershed economists and plant technicians were able to observe damage done to the crops by the varying periods of inundation. This information is added to studies of damage done during other periods of the year.

"The sum of this information sets up the problem for the hydrologist," according to H. T. Stanley, assistant State conservationist for watersheds. "He must measure, in advance, the effectiveness of works planned to remove the water from the land within a specified time."

Right answers are necessary when dealing with high-value crops. They are all-important to Florida growers who will depend on watershed projects. For example, a $700,000 celery crop was lost in 1958 on the Sarasota-West Coast watershed across the peninsula.

"We first plan measures to handle the runoff from one-day,

Note:—The author is information specialist, Soil Conservation Service, Spartanburg, S. C.



Citrus grove in Fellsmere drainage district after hurricane Florence had passed.

high-intensity storms," said Stanley. "Then we see how well these measures will handle the runoff during extended storm periods."

The soil was saturated when the eight-day storm began. Highest intensity of rainfall occurred on the third day. Five inches fell in a 4-hour period, and 7 inches fell in the 24-hour period.

Humidity was high and there was little evapo-transpiration. Practically all of the water had to be removed through inadequate canals. Water moves slowly in the flatlands. Fellsmere Canal, which drains most of the area, did not crest until four days after the heaviest rains fell.

"This points up the problem in hydrology," explained D. H. Esry, SCS watershed planning party leader. "Where runoff is faster, measures to reduce damage from the high-intensity rain may be sufficient. The 1-day rain of 7 inches can be expected on an average of once in 8 years. That is a big rain, but to handle it is a fairly simple problem. It is more difficult to handle the water during an extended storm period. Continuing rains complicate the problem. Larger canals may be required."

Entrance to the Corrigan ranch after 15 inches of rainfall.

Marion Holder, economist on the SCS team, outlined the flood tolerance of the crops to be protected.

Citrus trees in the Indian River area are grown on beds to give the roots two to three feet of soil above the water table. Flooding can be tolerated from 24 to 36 hours with only minor damage.

"The storm being studied inundated 1,900 acres of citrus from 3 to 7 days," he said. "Yields will be reduced. Permanent tree damage, which may not be seen for six months to a year, is inevitable. Our information indicates that damage will be from 40 to 80 percent. In that range, growers often destroy the groves and replant. Citrus loss was estimated at nearly $100,000."

Water covered 6,800 acres of sugarcane from 1 to 2 weeks. The cane was not seriously damaged by flooding, but the resulting delay in harvest and other costs ran the bill up to about $37,000.

Ten thousand acres of improved pastures were flooded up to 20 days. Four plots were set up to study residual damages. The first three are on the Pat Corrigan Ranch, and number four is on the Kenmore Ranch.

Plot 1 contained pangolagrass grazed to a 6-inch height to permit volunteer reseeding of Southern white clover, which was up to a good stand when the flood came. All of the clover and 5 percent of the grass were killed. A month later the grass had recovered. Clover seed was sprouting again, but the legume, which was to furnish January-to-June grazing for Corrigan's cattle, will come into production about three months late.

Plot 4 had been similarly managed. The clover was killed. A month later the legume seed was sprouting, but carpetgrass and common bahiagrass were continuing to deteriorate.

Plots 2 and 3 were in fields of ungrazed pangolagrass saved for winter forage. Roughage was lost, but a month later the grass had begun to grow again.

Pasture damage was estimated at $50,500 in loss of immediate pasture, loss of clover stand, and resultant loss of winter grazing. No estimate was made of added feed and handling costs.

"The sum of many studies like these will enable us to sharpen the definition of the level of protection needed," said Stanley.

James W. Woodfin, hydrologist of the party, pointed out that the

Sugarcane field in the Fellsmere drainage district after hurricane Florence passed.

rainfall pattern in the area is extremely varied.

"Average annual rainfall is 52 inches, but 39 inches of that comes in a 6-month period. About once every 8 years the annual rainfall jumps to about 70 inches. Then, too," he said, "severe rainstorms like the one that followed hurricane Florence may hit at any time."

Stanley and his group discuss the probability of these storms with the local group. "If they decide they want 50 percent protection during the largest storm expected on an average of once every 50 years, and complete protection from the 10-year storm, we have our problem," Stanley added.

"We then know that we must remove the runoff of the smaller storm from the citrus groves in 24 hours, remove water from sugarcane in 4 or 5 days, reduce the area of pasture flooded, and reduce the length of inundation on the remainder.

"The larger storm must be considered, too. If storm damages are to be reduced by half, the economist and the plant technicians determine how much reduction in area and duration of flooding will be necessary to accomplish this goal."

So the problem is set up and turned over to Woodfin. Woodfin "routes" the storms through ditches and canals or pumps of various sizes. He makes adjustments in specifications until the plan will meet the objectives.

Before the proposed solution is presented to local sponsors, the economist again comes into the picture. He calculates the benefits which will accrue. He compares these benefits with the cost of the proposed works of improvement. Benefits must exceed the costs.

"In the flatlands where water moves slowly," Stanley concluded, "we must plan the works of improvement so they will be effective during the short period of intense rainfall as well as the longer storm period."

Local Financing of Watershed Projects

By John I. Kincaid

FINANCING their portion of the cost is one of the major problems confronting sponsors of small watershed projects under the Watershed Protection and Flood Prevention Act (Public Law 566). Many projects with completed plans are yet to get into construction because of the inability or failure of local sponsoring organizations to meet their share of the cost.

A complete understanding by local people of their responsibilities in a watershed project is essential to the success of the project. The earlier this understanding is achieved, the better.

One of the first things that must be realized is that the local people must finance their part of the program, and the cost can run to a sizable sum. It is difficult to "poor boy" a project, especially a large project, to completion by contributions or arranging for other agencies to provide financing on a piecemeal basis.

In most instances the officers of local sponsoring organizations, particularly water control and improvement districts, are not in a position to perform all details necessary for successful operation of a project. They need legal, administrative, and secretarial help.

Financing needs may be broken down into at least four categories: Administrative, land rights, legal, and operation and maintenance.

Administrative costs include such items as furniture and office equipment; office space and other rentals; clerical help; administration of contracts; and such miscellaneous items as stamps, insurance, social security, bonds, and numerous other items or services.

Only the local sponsoring organization can estimate the cost of most of these items since they will vary depending upon the size of the project, amount of time directors and others devote to the project without charge, type of help employed, and many other local factors.

The cost of administering contracts alone may be considerable. It may include preparing and distributing bids; advertising for bids; travel in connection with checking equipment and financial status of successful bidders; working with contractors in negotiating and preparing modifications; handling claims and disputes of contractors; preparing partial payment estimates; making semifinal and final inspections; and preparing construction reports. This may entail paying a full-time salary to the contracting officer, especially on large projects. On the basis of our experience in working with local organizations, we believe that an average of about $500 per contract is a satisfactory figure for estimating these costs.

Land rights costs will vary greatly. Even where easements are donated, the costs will include such things as obtaining necessary signatures and recording of easements, negotiated damages, and installation of improvements not covered in the plans and specifications, such as ramps, bridges, and fences, and removal of buildings, utility lines, and other improve-

Note:—The author is area conservationist, Soil Conservation Service, Austin, Tex.

ments. These costs, not including condemnation and negotiated damage costs, may average $200 per structure or more, depending on local conditions.

The local sponsoring organization should realize in the beginning that it may have to purchase some land rights and will have other expenditures in the form of negotiated damages. The amount of funds required can only be estimated and here again judgement of local people must be relied upon.

The watershed work plan should contain an estimate of the values of the land rights to be furnished by the local sponsoring organization. These values can be used as a basis for estimating the cost of any easements that must be purchased.

Another approach might be to take the total acres planned in the sediment and detention pools of all structures in the watershed, and estimate the percentage of that acreage where land rights might have to be purchased. By using a per-acre evaluation for each—for example, $100 per acre for sediment pool acreage and $50 for detention pool acreage—an estimated amount needed for purchase of land rights could be determined.

In addition to this figure, an estimate of the cost to the sponsoring organization for relocation of roads, power lines, pipelines, improvements, and other miscellaneous costs in connection with land rights should be included.

Legal costs may include drafting easements and checking for legal adequacy, representation of the sponsoring organization in condemnation proceedings, and any other legal actions that may arise. Legal costs can be estimated only by local people. However, based on the experience of local sponsoring organizations now in operation, it appears that $200 per structure is a fair estimate of overall costs.

This figure will vary considerably, depending upon number of land rights involved, complications such as estates, and whether or not condemnation proceedings are necessary.

Operation and maintenance of works of improvement after construction is completed are the responsibility of the local sponsoring organization. The amount of funds required for this purpose will vary with the watershed, type of structures installed, and methods used by the sponsoring organization to carry out its maintenance responsibilities.

In discharging its obligations for operation and maintenance, the sponsoring organization must provide sufficient funds to maintain vegetative cover on structures and emergency spillways, control brush and weeds, maintain fences, remove debris from principal and emergency spillways, and make necessary repairs to structures or spillways. The cost will vary from year to year and with local conditions.

The local sponsoring organization must enter into an agreement satisfactory to the Administrator of the Soil Conservation Service prior to the construction of works of improvement. The agreement includes arrangements for defraying these operations and maintenance costs.

In Texas the sponsoring organizations provide a reserve fund of up to $25,000 for operation and maintenance, depending upon the number of units of construction. This is based on a formula of $1,000 per structure for the first 10 structures or first 10 miles of channel improvement, $750 per structure for the second 10 structures or miles of channel improvement, and $500 per structure or mile of channel improvement for remaining units until the $25,000 maximum is reached.

This reserve fund is accumulated by setting aside $200 per structure or mile of channel improvement each year until the required maintenance fund is obtained. This fund is maintained by replacing annual expenditures at a rate of $200 per year per unit of construction until the fund again reaches the required reserve. If the structure provides for multiple-purpose storage, the amount of funds for operation and maintenance is increased according to the cost for the added purpose.

To assist the local sponsoring organization in planning for necessary funds to carry out its financial responsibilities for the project, an overall budget should be developed to determine both annual and long-term needs.

How financing is provided is a matter to be determined by the sponsoring organizations. Since their legal powers of taxation vary greatly, depending upon the legislative or other acts creating them, such powers should be clearly determined before deciding on how necessary funds will be raised.

Usually a combination bond issue and an annual operation-and-maintenance tax offer greater flexibility and adaptation to the sponsors' needs.

Regardless of the financing method used, the size of the project, or the type of local sponsoring organization, an assured source of adequate income is essential and should be provided for as early as possible.

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A South Carolina farmer finds the watershed program helpful to honey production. J. H. Patten, of Pickens, S. C., said: "Four or five years ago I had to leave enough honey in each gum for the bees to winter on when I robbed them in June, because the bees couldn't find enough plants that had blossoms during the later summer months. The watershed program brought bicolor and sericea lespedeza to nearby eroding fields and power line rights-of-way, and my bees now can feed on the blossoms from these plants. They produce twice as much honey as before."

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Good weed control begins with clean seed.

Oklahoma District Sponsors Water Safety

By Ray Walker

SUPERVISORS of the Deer Creek Soil Conservation District scored a first in Oklahoma when they sponsored water safety demonstrations at Cobb Creek Flood Prevention Site 1, on July 10, 1960. A crowd estimated at 500 saw the various demonstrations held on the 158-acre lake, south of Weatherford.

The idea originated when the supervisors met with a committee of State and National representatives of the American Red Cross and the Soil Conservation Service. In addition to enlisting the cooperation of these two organizations, the supervisors asked help from the Southwestern State College at Weatherford, the Oklahoma Highway Patrol, the City of Weatherford, and sportsmen's clubs. A. M. Clements, SCS area conservationist, served as master of ceremonies.

Purpose of the event was to educate the using public and adjacent landowners to the hazards of water recreation and to help develop a water safety consciousness. The need of such a program was urgent.

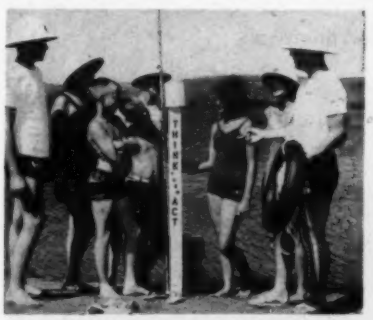
The senior group of performers and instructors at the water safety show on the Cobb Creek lake.

On Sunday, June 26, there were 40 boats and about 75 automobiles at Site 1. The people came to picnic, swim, ski, fish, and just have a good time. There were no lifeguards, no defined swimming area, no plan to control speedboat traffic on the lake, and no authority to enforce regulations had there been any. Just two weeks before the committee's visit, a college student lost his life trying to swim to a platform built far out in the lake.

The water safety demonstrations centered around six Red Cross Rescue Stations installed at the waterfront by the Deer Creek Soil Conservation District. Dan Hamill, SCS work unit conservationist, worked closely with the district supervisors in planning and staging the event.

Trained personnel demonstrated various types of equipment and rescue skills. Performers were members of the Senior and Junior Groups representing the Southwestern State College and City of Weatherford Recreation Swim Program. The program was directed by Dr. L. J. Van Horn, Water Safety Instructor Trainer, and Mrs. Glen Wright, Water

Note:—The author is State conservationist, Soil Conservation Service, Stillwater, Okla.



One of six Red Cross rescue stations installed at the waterfront of the Cobb Creek lake by the Deer Creek Soil Conservation District.

A demonstration on how to throw a life buoy for rescue operations at Cobb Creek lake.

Lt. Sid Barry (right) and patrolman Dan Combs of the Oklahoma State Highway Patrol Rescue Squad, who gave lectures and demonstrations on water safety at Cobb Creek lake.

Safety Instructor, both faculty members at Southwestern State College.

Charles Hartshorne, American Red Cross Water Safety and First Aid Services Director from Oklahoma County, explained the expert skier demonstration with 6 boats and 12 skiers. In his lecture, Hartshorne placed emphasis on having a third person in the boat. Winston Humphries, Southwestern State College student, read ski safety rules. Boats for the demonstration were provided by sportsmen's clubs.

Members of the Senior and Junior Life Saving Groups demonstrated approaches, releases, and carries in rescuing persons in danger of drowning. Use of a reaching assist also was demonstrated by two young swimmers trained in the Weatherford Recreation Swim Program.

State highway patrolman adjusts SCUBA gear before entering water for a demonstration at Cobb Creek lake.

Oklahoma Highway Patrol officers demonstrated the use of SCUBA equipment (self-contained underwater breathing apparatus) that held the undivided attention of adults and had the youngsters believing that a "man from Mars" had come to the event. The team also gave lectures and demonstrations of their specialized work and use of equipment on their rescue service truck.

The demonstration areas were "plastered" with colorful water safety posters provided by Richard Brown, Director of Water Safety of the American Red Cross, Washington, D. C. Joseph Racz, Red Cross field representative in Oklahoma City, gave valuable assistance in planning and staging the water safety show.

Increasing public use of the more than 1,500 floodwater lakes built under the small watershed and flood prevention programs has created a serious public water safety hazard. The need already is apparent for a program that will: (1) "Engineer" safety into the basic plans for construction; (2) alert and educate the using public to the hazards of water recreation and how to cope with them; and (3) determine and provide authority for enforcement of water safety rules.

At the present time in Oklahoma, there is no clear-cut understanding among boards of supervisors, public law enforcement officials, landowners adjacent to the reservoirs, or others as to responsibilities in permitting such recreational use, their liability in the event of tragedy, or their power to enforce regulations governing the safe use of these facilities. These problems are not confined to Oklahoma. The situation usually exists wherever there is an expanding watershed program.

The need for taking positive action to solve these problems and to safeguard the rights of the districts and landowners and the lives and rights of the using public is very urgent. Water safety shows similar to the one sponsored by the Deer Creek Soil Conservation District probably will be held in many sections of Oklahoma in 1961.

Multiple Benefits on the Shakopee

By Robert S. Anderson

SHAKOPEE Creek is a principal tributary of the Chippewa River in western Minnesota. The Shakopee watershed, which includes about 205,000 acres of farmland, is part of the Chippewa Tributaries and Hawk Creek pilot watershed protection project.

Flood prevention, erosion control, and reduction of sediment damages to farmland were the principle objectives outlined in the work plan for the Shakopee watershed. But developments have proved that waterfowl, upland game, and other wildlife also are principal beneficiaries of the watershed program as it nears completion.

Note:—The author is work unit conservationist, Soil Conservation Service, Montevideo, Minn.

Structural measures, including 2 floodwater retarding structures and 25 miles of floodway improvement, have been completed on the Shakopee. Land treatment measures in the upper part of the watershed are being applied by farmers at a stepped-up pace and are proving effective in controlling runoff and erosion. Flood and sediment damages to the lowlands were practically nonexistent in 1960.

The floodway, completed in 1959, not only controls flooding of adjacent farmlands, but also provides an outlet for farm drainage ditches. The two large floodwater retarding structures have, up to now, kept floodwaters down to the capacity of the floodway; and, in addition, they have created permanent lakes from formerly intermittent lakes and greatly enhanced their value to waterfowl and other wildlife.

The storage reservoir in the upper floodway is Swan Lake in Kandiyohi County. It has a surface area of approximately 700 acres and temporary storage capacity of 3,000 acre-feet. The storage reservoir in the lower floodway is Shakopee Lake in Chippewa County. This lake has a permanent pool of about 300 acres and has a temporary storage capacity of 2,000 acre-feet with a surface area of approximately 500 acres at flood stage.

The drop spillway in the floodwater retarding dam of Shakopee Lake.

The water control structure at the outlet of each lake consists of an earth-fill dam and a concrete drop spillway. They contain neither gates nor valves. These control structures maintain a stable pool level in the lakes throughout the summer. The water rises only during periods of heavy runoff from heavy rains in the watershed.

In the fall of 1958, there was less than five acres of water in Shakopee Lake. The control structure, completed just before freeze-up that winter, maintained a constant water level in the lake throughout 1959 and 1960. Even with less rainfall in 1959 than in 1958, there was 300 acres of surface water in the lake that fall.

There is a small local hatch of ducks, mostly teal, in both Swan and Shakopee Lakes. The chief advantage of the lakes to waterfowl is a stopover or resting area during the spring and fall migrations. In the falls of 1955, 1956, and 1957 there were up to 5,000 mallards feeding out of Shakopee Lake during the migrations. Needless to say, duck hunting was "tops" in the lake and the surrounding cornfields.

In 1958, due to the drought, there was only five acres of water left in the lake and this was used only by a few Great Blue Herons and Wilson Snipe.

In 1959 the big northern mallards returned. Again thousands of them used Shakopee Lake as a stopover during their southern migration. The 300 acres of shallow water provide just the spot for the ducks to use as headquarters between their daily trips to the neighboring cornfields. They remain here until the lake freezes, then take off for the south. Escape cover and nesting areas plus winter protection are provided for pheasants all along the shoreline of the lake. This makes the area ideal for the permanent production of pheasants and other wildlife.

Wildlife enthusiasts and sportsmen are happy with the new Shakopee Lake. The farmers in the watershed benefit from the controlled water and managed soil. The people in the cities downstream on the Chippewa River know that their flood problem has been greatly decreased.

Shakopee Lake, in the background, with floodwater retarding structure and floodway in the foreground.

Fish For Food

An international conference on fish in nutrition will be held in Washington, D. C., September 19–27, 1961, under the auspices of the Food and Agriculture Organization of the United Nations. About 400 representatives from 50 nations are expected to attend. Fundamentally, the conference will assemble scattered information on the nutritive value of fish, assess it, and stimulate future scientific investigation of this food source.

HYDROLOGIC RELATIONSHIPS ON WATERSHEDS IN OHIO

By Lloyd L. Harrold

HYDROLOGIC studies at the Coshocton, Ohio, Soil and Water Conservation Research Station have revealed general relationships, which have been used by the author in lectures to trainees participating in the training sessions held at the research station.

These principles and relationships are depicted by monthly averages of: (1) precipitation, (2) rainfall amounts at rates greater than 1.0 inch per hour, (3) runoff amounts for a 2-acre watershed and for a 27-square-mile watershed, (4) soil moisture, (5) percolation, (6) consumptive use, (7) flood peaks, and (8) erosion. These average patterns were developed mainly from the Coshocton Station watersheds. The concepts could apply widely to the humid section of the country where climate and geology are similar.

Nature supplies water to this area in the form of rain and snow in a pattern somewhat like that of Curve A of figure 1. Monthly amounts are usually greater in the growing season—an ideal situation for meeting crop demands for water. Lesser amounts are received in the cooler months of the dormant season.

Intensities of rainfall are likewise greater in the summer months as shown by curve B of figure 1. June and July have the greatest amounts of rain falling at rates exceeding 1.0 inch per hour. Along with high rainfall intensities, we find large raindrops with high velocity and energy.

Note:—The author is supervisory hydraulic engineer, Agricultural Research Service, Coshocton, Ohio.

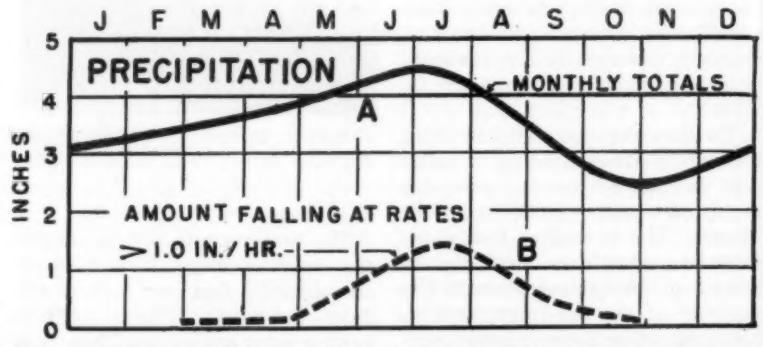


Fig. 1. Average monthly precipitation (curve A), and average monthly precipitation falling at rates greater than 1 inch per hour (curve B) at Coshocton.

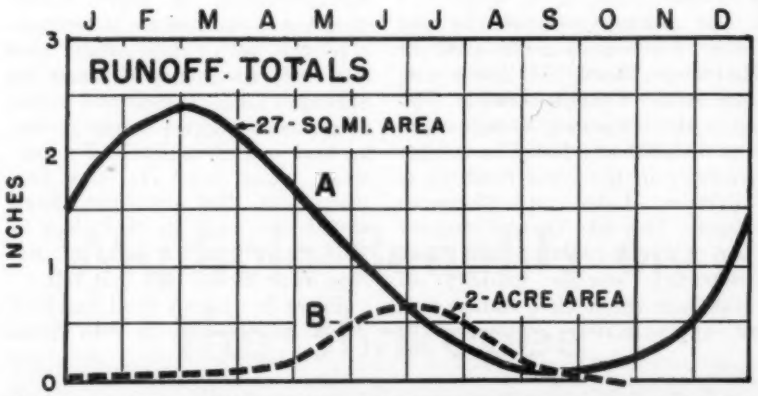


Fig. 2. Average monthly runoff totals from a 27-square mile watershed (curve A) and a 2-acre watershed (curve B) at Coshocton.

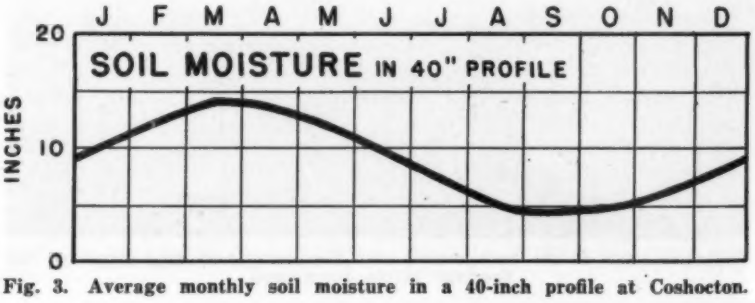


Fig. 3. Average monthly soil moisture in a 40-inch profile at Coshocton.

The average pattern of runoff from a 27-square-mile watershed (figure 2) does not follow closely the pattern of rainfall. Runoff volumes for this watershed, typical of those of 10 square miles and larger, are greatest in late winter and early spring. They are low for the summer and fall months. The precipitation pattern and the runoff pattern for this size watershed differ widely. Additional factors such as soil moisture and percolation, as discussed later, will help explain the reasons for this difference.

The average runoff pattern for a 2-acre watershed (figure 2B) reflects the pattern of rainfall, with relatively large amounts in the summer season and small amounts throughout the remainder of the year. This pattern is quite similar to that of amounts of rain falling at rates greater than 1.0 inch per hour (figure 1B).

Soil moisture in a 40-inch profile (figure 3) is generally high in March and April and low during September, October, and November. The period of depletion, May–September, coincides with the period of high rainfall; and the period of accretion, November–February, corresponds with the period of low rainfall. The consumptive-use pattern of figure 4 explains these apparent differences.

Consumptive use of water by vegetation, sometimes referred to as evapotranspiration, is shown in figure 4. Its pattern is high water use in the warm growing season and low use during the remainder of the year. It causes soil moisture depletion during the months of high water delivery. Low water use in October, November, and December allows the soil moisture to increase even though rainfall is in lesser amounts. Also, soil moisture evaporation follows closely the consumptive-use pattern.

The percolation of water into the rock beneath the root zone can be

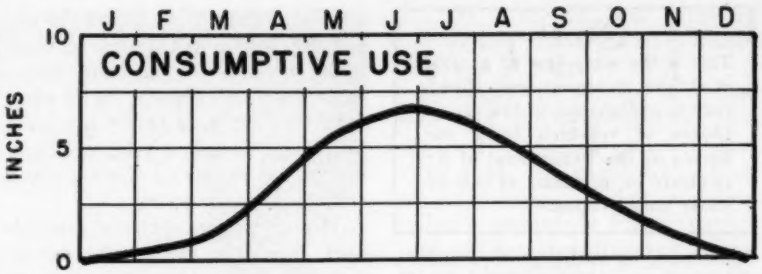


Fig. 4. Average monthly consumptive use of water by vegetation at Coshocton.

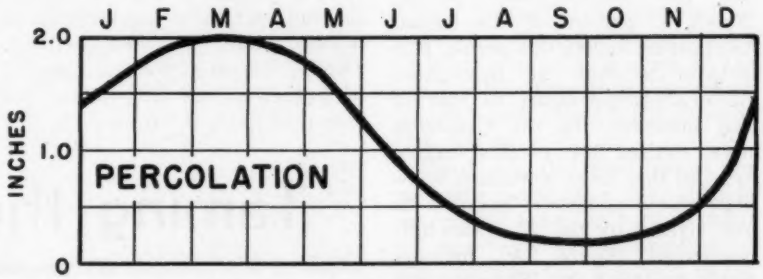


Fig. 5. Average monthly percolation of soil moisture into soil and rock formations beneath the plant root zone at Coshocton.

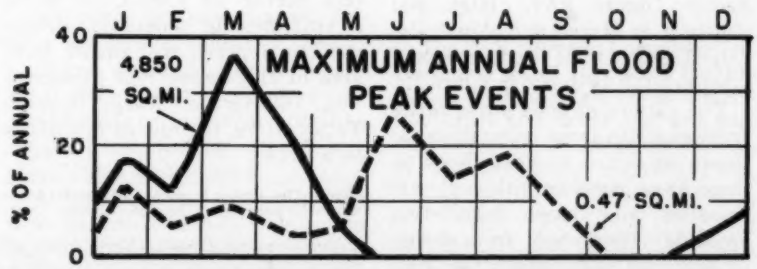


Fig. 6. The pattern of flood peaks on a 4,850-square-mile watershed and a .47-square-mile watershed near Coshocton.

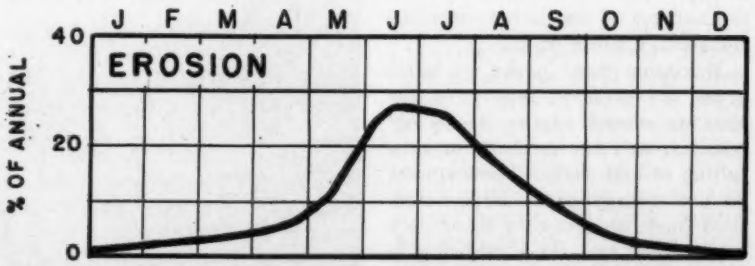


Fig. 7. The monthly soil erosion average at Coshocton, expressed in percent of the average annual erosion.

No. 61

This is the sixty-first of a series of articles to appear from time to time in explanation of the various phases of research being conducted by the Department of Agriculture on problems of soil and water conservation.

considered as recharge to aquifers. It is measured at the 8-foot depth of the Coshocton lysimeters. Percolation (figure 5) is greatest during the January–May period. About 85 percent of the annual total occurs during this period. It is natural to find the percolation pattern corresponding to that of soil moisture. In the Coshocton area, aquifer flow reaches surface streams that lie at elevations below that of the aquifers. The flow in the stream of the 27-square-mile watershed (figure 2A) includes much aquifer flow. When the soil moisture was high, the aquifer recharge was great and its contribution to stream flow was quite sizable (figure 2A). High soil moisture in March and April also helped cause some surface runoff from rainfall as shown in figure 2B.

The pattern of flood peaks varies from small to large watersheds, as shown in figure 6. Peak flows on large areas coincide with high soil moisture and large percolation amounts. They result from storms of relatively low intensity, covering large areas, and lasting for several days. Rates of flows from small watersheds at that time are relatively low, but in a large-area storm the number of small-area contributions build into a flood.

Maximum flood peaks on small areas are confined mostly to the growing season (figure 6). They result from large amounts of rain falling at high rates. These storms do not usually cause large-watershed floods because they cover only small areas and their duration is short.

Finally, the erosion from fallow ground (figure 7) is highest in the growing season at the time of maximum flood peaks on small areas, coincident with high-intensity rainfall. Soil moisture in the root zone at this season is generally not high, except for relatively short periods following heavy rains.

The above concepts are generalized. Yet they depict the fundamental relationships of hydrologic factors involved in water management on agricultural land. Based on these concepts, the job ahead for the soil and water conservationist becomes clear. The season of high rainfall coincides with the season of ground tillage to produce the season of greatest erosion. At this time, rainfall occurs at high rates and in large drops. The land surface must be protected against erosion and the sealing of its pores. The relatively low moisture content of the soil during this season denotes available pore space. The conservationist should strive to have more of this soil pore space used to absorb summer storm rainfall. This would help reduce upland floods and provide more moisture for stabilization of spring flow.

Similar concepts can be developed for other climatic and physiographic regions. More precise values within each region can be developed from actual measurements.

Taming the Pit River

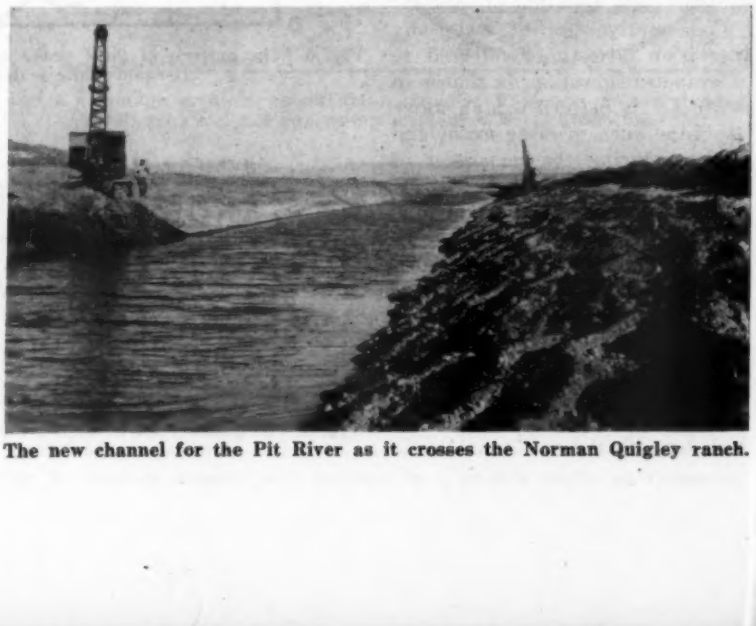
By Arnold E. Bullock

FLOODING is a serious problem on the Pit River, in the northeast corner of California. It is a swift-flowing mountain stream until it reaches the almost level area of the Canby Soil Conservation District in Warm Springs Valley. Here, the rate of flow slows to a crawl.

Note:—The author is work unit conservationist, Soil Conservation Service, Alturas, Calif.

The meandering river forms many oxbows and ponds. Flooding occurs every few years, aggravated by restrictive irrigation dams and bridges. Overflow water often forms secondary channels. In some years, large areas are too wet for high-quality hay and small grains, yet this is some of the most valuable land in the Valley.

Interest in eliminating seasonal



The new channel for the Pit River as it crosses the Norman Quigley ranch.

Aerial view of the Pit River as it crosses the Rouse and Quigley ranches. The light line shows the straightened channel; the darker lines indicate former channels and floodplain.

flooding and achieving better control of irrigation water provided the greatest stimulus for the formation of the Canby Soil Conservation District.

Will Rouse, a rancher in the district, decided that he wanted something better than broadleaf sedges and willows growing on his best land. He discussed this with his downstream neighbor, Norman Quigley, who was concerned with the same problem. Rouse had some large earthmoving equipment, so they decided to do whatever was necessary to gain control of the river.

They applied for ACP cost sharing under a pooling agreement and were referred to the Soil Conservation Service for engineering assistance. SCS engineers collected all available flow data from measurements taken by the California State Division of Water Resources and made the necessary surveys to design a channel and levees that would contain the Pit River during periods of peak runoff.

Although the new channel follows the general course of the old river bed, and utilizes the old channel to the greatest practical extent, considerable construction work was required to eliminate the many sharp turns and oxbows.

A typical cross section of the new channel is 71 feet wide at the top, 50 feet wide at the bottom, 7 feet deep, and has 1½-to-1 side slopes. The channel has been designed to carry 1,525 cubic feet per second. When the 3-foot-high levees have been completed along the new channel, the peak capacity will be approximately 3,000 c.f.s. Each levee will be constructed so that the inside toe is 20 feet from the top of the channel bank.

To date approximately 5½ miles of the river channel have been realigned and improved. This will benefit approximately 1,300 acres of irrigated hay land. The work was done at a total cost of about $63,000, or $48 an acre. About $17,000 of the cost was borne by the Federal Government through ACP cost sharing.

Although the average frost-free season of 77 days precludes the production of cash crops on any large scale, the production of an adequate supply of hay and late summer pasture is highly important to the range livestock industry in Modoc County. The ranchers feel that comparatively high costs per acre are well justified.

Several of the ranchers in the Canby district are interested in improving the remaining 20 miles of channel as well as some of the smaller tributary channels, which would benefit about 5,400 acres of irrigable land.

The Canby district directors are currently exploring all possible sources for financing further channel improvement, construction of new and adequate diversion dams, and other water control measures of great and lasting benefit to this community.

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The U.S. Senate Committee on National Water Resources has reported that there are about 10 million cattle and calves and 6½ million sheep on irrigated farmlands at the beginning of each year. About one-third of these animals are raised entirely on irrigated farms. The 3 billion pounds of beef and veal, plus 500 million pounds of lamb and mutton, produced on irrigated lands are an average of 20 pounds of meat per person.

◆

In the Southern Great Plains, rock formations yield large quantities of ground water to wells. At present, these formations hold great quantities of water. But only about .2 inch of the annual precipitation reaches the groundwater supply. In 1935, annual withdrawals by pumping were about equal to the recharge rate—50,000 acre-feet. In 1958 the withdrawal was 7 million acre-feet.

The Ladies Help Steer

By Herbert I. Jones

WHEN watershed protection and flood prevention become a reality in the Gering Valley of Nebraska, residents there will owe special thanks to a group of 20 women who were members of the steering committee, working for orderly watershed development in the community.

Not that the men haven't worked on the watershed problem for a good many years, too. But when the chips were down, it was the wives who delivered 1,023 signatures on the petition to set up a watershed organization. And they did it in less than a week!

This was not a curiosity signup, either. It was the real thing. The name of a property owner on the petition meant a probable tax obligation of up to two mills to support the organization under Nebraska law.

The women's participation grew from necessity. Their husbands could spend little time away from the fields in the rich valley where they reap a living from potatoes, sugar beets, alfalfa, and grain. Though they cast anxious eyes at thunderheads and worried about the possibility of floods, they dared not leave their irrigation to work for watershed organization. Occasionally, they did steal away at night for a get-together, but then only briefly.

At a meeting conducted by the Scotts Bluff Soil and Water Conservation District last spring, they learned that the time for scheduling watershed planning was near. If they expected to be included in that year's flood prevention work, they needed to get busy.

Mrs. Arthur Weinhold (left) and Mrs. Ray McKeeman, the first women members of the steering committee for the Gering Valley watershed project.

That's when district supervisor Arthur Weinhold suggested adding ladies to the steering committee—and volunteered his wife!

Mrs. Weinhold knows the Gering watershed and what floods mean. And so do Mrs. Albert Hengelfeldt and Mrs. Ray McKeeman, who were the first to agree to help.

They have watched runoff sweep down the slopes near historic Scotts Bluff and across dryland fields, pastures, and irrigated farms to the city on the banks of the North Platte River. It happens every year, sometimes more than once.

In the series of floods in May and June 1955, damage to irrigation systems, drains, roads, and bridges ran near $100,000. Land and crops suffered another $50,000 damage. One authority reported that even this total was dwarfed by the serious bank and channel erosion whittling off huge chunks of $500-an-acre cropland.

Pioneer watershed efforts concentrated the flows that spread

Note:—The author is information specialist, Soil Conservation Service, Denver, Colo.

The Gering Drain started, years ago, as a couple of plow furrows; but toward its lower end, in the heart of the best irrigated land, it is now a large gully that continues to devour good farmland.

Farmer P. A. Scarlett signs the petition for a Gering Watershed Association presented by Mrs. Ray McKeeman (left) and Mrs. Albert Hengelfeldt.

across the flat valley in a channel known as the Gering Drain. At one time it was just a couple of plow furrows. Now it's a sand-scoured land hog with numerous treacherous tributaries.

After a quick meeting to double-check their plans, Mrs. Weinhold, Mrs. Hengelfeldt, and Mrs. McKeeman set out to organize the wives in the valley.

About 25 women answered their call to meet at the Community Club. There they listened as Mrs. Weinhold explained the gravity of petitioning. A school census map was spread out and the ladies subdivided the valley. Then they assigned the areas for which each would be responsible.

Next day they were out in force, systematically covering the 33,000 irrigated and 27,000 dryland acres that comprise the Gering watershed area.

Forty-eight hours after they took on the job the women had 90 percent of the farmers and ranchers on the dotted line. Then they regrouped before canvassing the homes in Gering. Long after they had enough signers, they kept on. Though they made repeated calls at some homes, they never did actually see all 1,200 eligible voters. But they came mighty close.

Caught by this enthusiasm, the steering committee took the petition to the Capitol in Lincoln and outlined the project to the State Conservation Board. The board gave it high priority on their schedule, and the application received approval by the SCS in August 1960.

A Soil Conservation Service watershed planning party was on the job by September, and work plans for the project were completed early in 1961. The Gering Valley folks are now anxiously awaiting the start of structural works along the drain and its tributaries. In the meantime, farmers of the valley are working toward improvement of their conservation farming and irrigation practices, so essential to the success of the project.

Fertilizing Flood Prevention Structures

By James Guillory

VEGETATING floodwater-retarding dams, spillways, and disturbed areas is going modern in Louisiana.

The distribution of fertilizer was an expensive and time-consuming item until an airplane was employed. Use of the airplane saved nearly half the costs, cut the time from six days to less than one day, and secured more even distribution.

In two jobs on Bear Creek watershed, the first required 31 tractor-hours with driver and spreading equipment, plus 190 man-hours for laborers to distribute fertilizer on the steep slopes by hand. Total cost for 25 acres was $444.25 or $17.77 per acre.

It took an airplane six hours to distribute the fertilizer on 35 acres. Total cost was $339.50, or $9.70 per acre.

One thousand pounds per acre was used on each job.

The savings in headaches and the time of SCS and district personnel was at least equal to the savings in money.

Note:—The author is work unit conservationist, Soil Conservation Service, Oberlin, La.

Airplane spreading fertilizer on floodwater retarding structure in Bear Creek watershed.

Saving and Using the Runoff

By Donald N. Davison and Verl G. King

WENDELL WELLING, who farms in Idaho's Bear Lake SCD, had water problems. Excess water from winter runoff, water from springs, and drainage water from wet meadows plagued him during the spring and early summer, while lack of water for proper irrigation was a problem during late summer. He is now collecting this spring runoff and putting it to good use.

Welling has for years watched water from two springs near the center of his ranch flow across his land and into the Bear River at his farm boundary. Appreciating the value of such a resource, he began to explore means of developing this stream for beneficial use. The building of two dams to store the water during the winter for use during the irrigation season was the result of his exploration.

With technical assistance from the Soil Conservation Service, Welling completed his plans in 1959 and completed the dams by August 1960. Cost-sharing assistance was furnished through the ACP Program by the County ASC Committee.

The dams were built at locations where the maximum winter runoff, spring flow water, and any water obtainable from drainage could be collected.

The larger dam was started in the fall of 1959 and completed in the spring of 1960. Winter runoff and water from a spring above the dam filled the reservoir by March 1960. The dam is 420 feet long and 28 feet high. It holds approximately 133 acre-feet of water and backs water over 13 acres.

The smaller dam was constructed during the summer of 1960. This dam also collects winter runoff and water from several springs. The reservoir is designed to hold about 9 acre-feet when full.

Water flowing from the outlet structure of the large dam on the Wendell Welling farm.

A tile drain approximately 1,000 feet long was installed above the smaller dam in a wet meadow. The upper end of the tile line also collects water from several springs. A structure was built at the outlet end of the drain to direct the spring water through a line to the large reservoir or deliver it directly into the smaller reservoir. Reservoir heights are at the same elevation and the top one foot of water can be interchanged without pumping.

Welling installed a gasoline-powered pump, mainline, and sprinkler system at the large dam last summer, and used it successfully. He plans to use a similar system at the smaller dam.

A natural gas line runs through the farm close to the two dams and the operator plans to convert his motors to natural gas power for greater economy.

Note:—The authors are, respectively, work unit conservationist, Montpelier, Idaho, and engineer, Preston, Idaho, both of the Soil Conservation Service.

Wendell Welling at the trickle-tube spillway in the larger dam on his farm.

Welling and SCS technicians calculate that the combined water from both dams should irrigate adequately about 450 acres. The entire farm consists of 1,862 acres, of which 62 acres are hilly and rocky and considered nonfarmable. The nonirrigated farmland will have a winter wheat-fallow-alfalfa grass rotation. Sweetclover will be seeded with every third grain crop as a green manure.

Welling is so pleased with the results of his investment that he is already planning more drainage installations to add water to his supply. He is also considering a large feedlot for his farm which would furnish a ready market for his grain, hay, and straw, and also supply needed barnyard manure for his cropland.

Due to the short growing season (approximately 95 days) in the Bear Lake area, it is difficult to grow crops other than small grains, hay, or pasture. Welling plans to experiment with seed potatoes on a small acreage which, if successful, would provide an alternate crop for his irrigated acreage.

When asked whether he felt that his investment in the dam would pay dividends, Welling's answer was an emphatic "yes." Being aware of the increasing demand for water, and the shrinking farmlands of the United States, his answer was typical of those farmers who are looking to the future—who are taking every opportunity to develop their natural resources in preparation for the demands which will be made upon the American farmer in the future.

◆

Don't apply lime just because someone says it's a good idea, or because your neighbor got excellent results from liming. On the other hand, don't wait to apply lime because your neighbor didn't get any response. His soils may not have needed lime.

Hans L. van Leer of Massachusetts

WATERSHEDS and urbanization are keeping Hans L. van Leer on the run. Meetings, talks, and conferences take him to all parts of the country. And watersheds and urbanization are only part of the coordinated soil and water conservation program in which he is actively interested.

As a director of the National Association of Soil Conservation Districts, a director and past president of the Massachusetts Association of Soil Conservation District Supervisors, and chairman of the Middlesex Soil Conservation District board, van Leer has been a key figure in developing important policies on a number of conservation problems facing the Nation and his State. He helped prepare Massachusetts legislation that authorized State financial aid in paying for easements and rights-of-way in watershed projects.

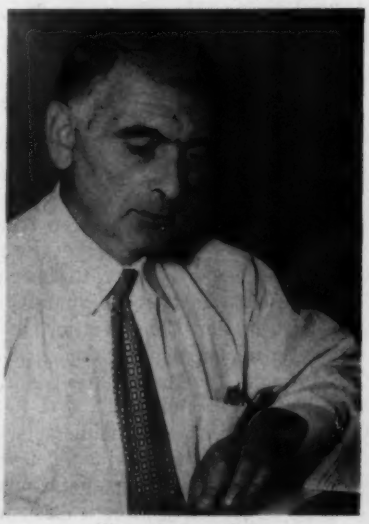
"I'm in favor of local participation and financial responsibility, but in the congested Northeast we have special watershed problems," he said. "The Suasco watershed is an example. That's the most important conservation job facing the Middlesex and Northeast Worcester County Soil Conservation Districts. There are 31 towns in the watershed and Massachusetts law does not permit one town to appropriate money for work to be done in another town. So we needed State money to get the project going.

"The pressure on land is increasing so fast that we have to hurry. The cost of land in the Baiting Brook watershed has doubled in the last three years. That gives you an idea of what we're up against."

To be done properly, watershed work takes so much time that van Leer believes that the districts need an executive secretary. Such an employee would spend most of his time working with town and State officials. That kind of work is beyond the normal duties of a district supervisor, he feels. Likewise, he sees the need of a State employee who would work exclusively with districts sponsoring watershed projects. That employee could also work with all districts on other matters, such as newsletters, he said.

Van Leer says that urbanization makes up the second largest problem facing his district. And he points out that in many parts of the country, including most of the Northeast, it's the most serious conservation problem.

"In the past 4 or 5 years, requests for district help have come to a larger extent each year from nonfarmers, from urbanites," van Leer emphasized. "Our district has



Hans L. van Leer

adopted the policy of giving help first to farmers and to consider urban requests in the light of the needs of the land. For example, if a city man buys a farm that he doesn't want to operate commercially but wants to conserve the soil and water resources, we provide technical advice."

The National Association of Soil Conservation Districts is doing a good job of keeping the public informed on the urbanization problem, van Leer believes. "But," he adds, "we haven't gone far enough. We need to persuade State planning boards to take our point of view. We need to get associated in an advisory capacity with town and county planning boards."

Van Leer is doing his part. He's a member of the Town of Lincoln appeals board that deals with zoning. He has talked at local, area, and national soil conservation district meetings from coast to coast. At every opportunity he addresses town and city planning boards and groups doing research on urban renewal. He helped to create the Massachusetts Water Resource Commission. In the National Association of Soil Conservation Districts he is chairman of the rural-urban and the information and publications committees.

Despite all these outside activities, van Leer maintains a close watch over his farming operations on Old Sudbury Road, South Lincoln, Mass. —LESTER FOX

8th National Watershed Congress

"Count Down on Water" is the general theme of the 8th National Watershed Congress that meets in Tucson, Ariz., April 17–19, 1961.

The National Watershed Congress was conceived and fostered by more than 20 of the Nation's leading industrial, agricultural, and conservation organizations 8 years ago. It is dedicated to improved management and use of natural resources on a watershed basis. Its yearly meetings afford a forum for the discussion of ways and means of expediting and broadening local watershed programs.

The daily themes for the Congress have been announced as: "Planning for Water Use," "Multiple Use of Watersheds," and "Water for a Thirsty Land." National problems will be discussed mainly during the first two days, while the third day will feature discussions of water problems for Arizona and the Southwest.

World Farm Output Sets Record

The World Agricultural Situation, 1961, a 47-page report by the Foreign Agricultural Service, forecasts world output of farm products in the year ending June 30, 1961, at 42 percent above the 1935-39 level and 2 percent above the previous record set last year. All major regions of the world except eastern Europe are expected to show increases in farm output this year. The report also points out that the volume of U.S. farm output is about equal to that of Mainland China and almost 60 percent larger than the Soviet Union's. But on a per-capita basis, the statistics show that production in the U. S. is about twice that of the Soviet Union, about four times larger than Mainland China's, but about the same as that of Canada, and only half that of Australia and New Zealand.

Soil Surveys

Soil surveyors of the Soil Conservation Service made field soil maps of more than 50 million acres during fiscal year 1960, an increase of 2 million acres over 1959. Also, 38 soil survey reports and maps were published, and 27 additional reports were prepared and made ready for printing. As of June 30, 658 million acres had been mapped in sufficient detail for soil and water conservation planning on farms and ranches and small watershed projects. This is about 34 percent of the total land area of the U. S. and about 53 percent of the agricultural land in the Nation's 2,861 soil conservation districts.

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U.S. farm output in the 1950's rose faster than U.S. population—27 percent compared to 19 percent.